



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.09.2018 Bulletin 2018/36

(51) Int Cl.:
E01F 15/08 (2006.01)

(21) Application number: **17159196.9**

(22) Date of filing: **03.03.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **SVEDBERG, Joakim**
832 53 Frösön (SE)
• **SUNNERHEIM SJÖBERG, Hanna**
832 42 Frösön (SE)

(74) Representative: **AWA Sweden AB**
P.O. Box 665
831 27 Östersund (SE)

(71) Applicant: **Safety Solutions Jonsereds AB**
832 96 Frösön (SE)

(54) **SAFETY BARRIER ELEMENT**

(57) Safety barrier element (100) comprising a base portion (110); a top portion (120); a first side wall (130); a second side wall (131) being arranged opposite the first side wall; a first end wall (140); and a second end wall (141) being arranged opposite the first end wall. The top portion comprises a first anchoring member (150) and a second anchoring member (151), the first anchoring member being arranged at a first end of the safety barrier element and the second anchoring member being arranged at a second end of the safety barrier element. The safety barrier element further comprises a connector (160) arranged to connect the safety barrier element with an adjacent safety barrier element by means of anchoring

members of the respective safety barrier elements. The connector comprises a rear portion (161) and a front portion (162), the rear portion being arrangeable at the first anchoring member of the safety barrier element and the front portion being arranged to engage with the second anchoring member of the adjacent safety barrier element, and the front portion is arranged to automatically enter a locked engagement with the anchoring member of the adjacent safety barrier element.

The automatic locking between the front portion of the connector and the anchoring member of the adjacent safety barrier element provides a safe and efficient way to interconnect two safety barrier elements.

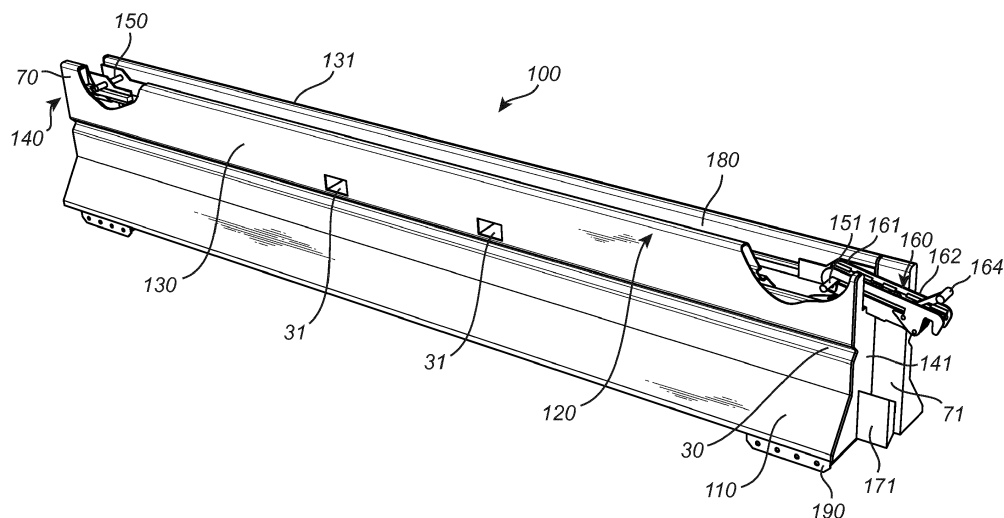


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a safety barrier element for use in vehicular traffic environments, and a system comprising multiple safety barrier elements which are interconnected.

BACKGROUND OF THE INVENTION

[0002] Vehicular safety barrier systems are used to restrict vehicle access to limited areas, for example along the highway between driving lanes of opposing directions, or around an area undergoing constructional or road work. In the latter case, temporary safety barrier systems are often employed. These can be assembled around or along the affected working area for the time necessary and are subsequently removed.

[0003] Temporary safety barrier systems are faced with requirements both on safety, such to provide a secure barrier for vehicle impact so that a person transported in an impacting vehicle is minimally harmed; and on assembly seeing that the systems are to be assembled and disassembled multiple times and possibly over large distances. Another important aspect to the assembly of safety barrier systems is the safety of the operator who carries out the assembly. Considering that the safety barrier systems consist of elements that usually are very heavy, accidents related to intervening actions from the operator of these elements are reoccurring.

[0004] In order to facilitate the transport, temporary safety barrier systems often consist of multiple barrier elements and means for coupling the same.

[0005] EP1157167 discloses a road barrier comprising coupling means located at the base and at the top of both sides of each barrier end, the coupling means comprising latch plates that engage bolts located at an adjacent barrier element end. A problem with this system is that a rather exact position of the road barrier is required in order to activate all four coupling means. To reach the coupling position, operators may need to manually intervene and thus, considering that road barriers often are very heavy, subject themselves to the risk of getting their fingers caught in the act, or for other related accidents to occur.

[0006] The cited patent further specifies that the therein defined latch plates do not withstand high loads and suggests, for a better performance of a linked line of barriers when impacted by a vehicle, plates bolted between two juxtaposed road barriers to be used as coupling means. In this case, manually bolting the coupling means becomes very time-consuming when assembling and disassembling a considerably long safety barrier system.

SUMMARY OF THE INVENTION

[0007] It would be advantageous to provide a safety

barrier element that can be assembled and disassembled with other safety barrier elements such to provide a safety barrier system in an efficient and safe manner

[0008] To better address this concern, in a first aspect of the invention there is presented a safety barrier element comprising a base portion; a top portion; a first side wall; a second side wall being arranged opposite the first side wall; a first end wall; and a second end wall being arranged opposite the first end wall. The top portion comprises a first anchoring member and a second anchoring member, the first anchoring member being arranged at a first end of the safety barrier element and the second anchoring member being arranged at a second end of the safety barrier element. The safety barrier element further comprises a connector arranged to connect the safety barrier element with an adjacent safety barrier element by means of anchoring members of the respective safety barrier elements. The connector comprises a rear portion and a front portion, the rear portion being arrangeable at the first anchoring member of the safety barrier element and the front portion being arranged to engage with the second anchoring member of the adjacent safety barrier element, and the front portion is arranged to automatically enter a locked engagement with the anchoring member of the adjacent safety barrier element.

[0009] The automatic locking between the front portion of the connector and the anchoring member of the adjacent safety barrier element provides a safe way to interconnect two safety barrier elements as there is no need for operators to intervene. The safety barrier element comprising the connector can be lifted in from a side by means of a mechanical crane or hook, and positioned next to another safety barrier element. Even when lifted in from a side angle, the connector can engage with the anchoring member whereby the front portion of the connector automatically enters a locking engagement. This also provides a highly efficient manner of interconnecting safety barrier elements. Once a safety barrier element has been set down in place with the mechanical crane or hook or similar, such that the connector engages the anchoring member of the adjacent safety barrier element, no additional step, such as for example bolting, is required to accomplish interconnection of the two safety barrier elements.

[0010] In accordance with an embodiment of the safety barrier element, the connector comprises a connecting part, wherein the front portion of the connector comprises a front portion of the connecting part, and the rear portion of the connector comprises a rear portion of the connecting part. The front portion of the connector further comprises a locking part, pivotally connected with the connecting part and arranged to provide the locked engagement in conjunction with the connecting part.

[0011] In accordance with an embodiment of the safety barrier element, the front portion of the connecting part comprises a connecting hook, and the locking part comprises a locking hook arranged to cooperate with the connecting hook, such that, when the rear portion of the con-

connector is arranged at the first anchoring member of the safety barrier element, the connecting hook is arranged to engage with the second anchoring member of the adjacent barrier element, and the locking hook is arranged to lock the engagement. This arrangement provides for a safe locking engagement, being highly unlikely to unlock unintentionally. Only upon application of a lifting force to the locking hook, whereby it is removed from the anchoring member, can the locking engagement be released.

[0012] According to an embodiment of the safety barrier element, the connecting part comprises a top part and a bottom part which are elongated and pivotally interconnected at a rear end of the connector.

[0013] According to an embodiment of the safety barrier element, the top part further comprises the connecting hook at its front end, and the locking hook is in a pivotal connection with the top part, the pivotal connection being arranged rear of the connecting hook.

[0014] According to an embodiment of the safety barrier element, the connector is arrangeable in an idle position and at least one of an activated position and a locked position. In the idle position does not protrude from the safety barrier element side and end walls. This proves advantageous for storing and transporting of the safety barrier elements, as the space occupied by the same is reduced. The idle position further provides a protection for the connector from impacts that can occur when loading or unloading the safety barrier elements for transport or storage, which could constitute a risk for damaging the connector. From another perspective, it is also a lesser risk that the connector, and thus the safety barrier element in general, causes injuries or damage to the operator manipulating the same while in the idle position.

[0015] The connector can be moved to an activated position prior to the unloading of the safety barrier element from the transporting means to the road. From the activated position, it can automatically enter a locking engagement with an anchoring member of an adjacent safety barrier element as the connector is lowered over the same, without any further interaction of an operator. Alternatively, the connector can be moved to the activated position once positioned next to another safety barrier element. Here, the connector enters the locked position upon entering in contact with the anchoring member of the adjacent safety barrier element due to the automatic locking them between. The connector is, thus, moveable from an idle to a locked position.

[0016] According to an embodiment of the safety barrier element, the connector is slideably movable between the idle position and the activated position. For this, the connector comprises an internal channel on which the anchoring member of the safety barrier element to which the connector is engaged can slide as the connector is pulled by the front portion from an idle to an activated position, or vice versa.

[0017] According to an embodiment of the safety barrier

element, the connector is arranged in a longitudinal direction of the safety barrier element when in the idle position. In this embodiment, the connector rests at least partly on a supporting structure of the body of the safety barrier element, such as the bottom of the channel.

[0018] According to an embodiment of the safety barrier element, the connector is releasably arrangeable at any one of the first and second anchoring members. The connector being arrangeable at either of the first or second anchoring members, provides an advantage in the assembly of a safety barrier system comprising multiple safety barrier elements that are interconnected. Such a system could be assembled in a more efficient manner due to the possibility of simply moving the connector from one side to another should it be necessary, instead of turning the entire safety barrier element around.

[0019] According to an embodiment of the safety barrier element, the connector comprises a release arm which is operable to release the locked engagement with the anchoring member of the adjacent safety barrier element. The release arm offers a safe means for operating the connector from and to a locked position without any risk for the operator to get fingers caught in the locking engagement.

[0020] According to an embodiment of the safety barrier element, the safety barrier element comprises a first and a third protrusion arranged at the first end wall, and a second and a fourth protrusion reversely arranged at the second end wall, whereby the first and the third protrusions are arranged to overlap with the second and fourth protrusions of an adjacent safety barrier element. The protrusions are arranged such to provide a guidance of the safety barrier element when it is positioned next to another safety barrier element. Once the protrusions of the adjacent safety barrier element ends engage, the safety barrier element which is being positioned can be approached completely towards the adjacent safety barrier element, whereby the connector of the safety barrier element enters in contact and thus in a locking engagement with the anchoring member of the adjacent safety barrier element. The engagement of the protrusions of two adjacent safety barrier element ends furthermore contributes to a more resistant coupling of the safety barrier elements, resulting in a higher resistance of a safety barrier system, comprising multiple interconnected safety barrier elements, to vehicle impact.

[0021] According to another embodiment of the safety barrier element, the third protrusion consists of a protruding portion of the first side wall of the safety barrier element, and the fourth protrusion consists of a protruding portion of the second side wall of the safety barrier element.

[0022] According to another embodiment of the safety barrier element, the top portion of the safety barrier element comprises a channel extending longitudinally along the entire safety barrier element. The channel houses at least part of the connector and the anchoring members, and can furthermore provide fastening portions such as

loops, and screws. These fastening portions can be used as points with which lifting devices such as cranes can engage to move the safety barrier element in a safe manner. The channel also enables tilting the safety barrier element using the shovel of an excavator. This could provide a great advantage, for instance in the case the safety barrier element accidentally is tilted such that it falls over to the side. It could then be tilted back in place using the shovel. The channel can furthermore be used to hold auxiliary equipment such as lights, signposts, noise barriers and railings.

[0023] According to an embodiment of the safety barrier element, the channel further comprises opposite channel side walls, wherein each channel side wall is provided with a groove extending longitudinally along the entire channel. The grooves and the channel provide means for holding and retaining auxiliary equipment such as traffic signs or light posts, possibly used to guide the traffic around the temporary work zone that the safety barrier system encloses.

[0024] According to an embodiment of the safety barrier element, the safety barrier element further comprises downwardly extending members at the base portion, so arranged to provide feet on which the safety barrier element rests.

[0025] According to an embodiment of the safety barrier element, the feet of the base portion are thinner than half the width of the longitudinally extending channel of the top portion, such that the safety barrier element is stackable. The feet are arranged to be stacked in an overlapping manner such that, when two safety barrier elements are juxtaposed with their longitudinal sides aligned, the feet on one side of one safety barrier element and the feet of the adjacent side of an adjacent safety barrier element can rest in the channel of one underlying safety barrier element. No additional stacking material is thus needed. This provides a benefit in terms of both time and space for loading and unloading multiple safety barrier elements. It also provides for a safer working environment, seeing that the safety barrier elements can be unloaded and loaded by mechanical means without the need of having an operator on the truck for handling any additional stacking material.

[0026] In accordance with an aspect of the present inventive concept, there is provided a safety barrier system comprising one or more safety barrier elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The invention will now be described in more detail and with reference to the appended drawings in which:

Fig. 1 is a perspective and partly cutaway view of an embodiment of a safety barrier element according to the present invention;

Fig. 2a - 2b are perspective and partly cutaway views of the embodiment of Fig. 1, with a connector at two

different positions, and Fig. 2c is a cross-sectional side view of a connector in a locked position interconnecting two adjacent safety barrier elements according to the present invention;

Fig. 3a - 3b show cross-sectional views of an embodiment of a connector in open and closed configuration, respectively, and Fig. 3c illustrates a side view of another embodiment of a connector according to the present invention;

Fig. 4 shows an exploded perspective side view of another embodiment of a safety barrier element and connector according to the present invention;

Fig. 5a - 5c are perspective and partly cutaway views of another embodiment of a safety barrier element according to the present invention;

Fig. 6a-6b show top views of an embodiment of two adjacent safety barrier element ends, and Fig 6c is a top view of the same safety barrier element ends with a connector connecting the two safety barrier elements according to the present invention.

Fig. 7a and 7b are perspective views of an embodiment of a channel of a safety barrier element according to the present invention;

Fig. 8 illustrates an end view of an embodiment of stacked safety barrier elements according to the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0028] In the drawings, like numbers refer to like elements.

[0029] Referring to Fig. 1, which is a perspective, partly cutaway, side view of an embodiment of a safety barrier element 100 according to the present invention, the safety barrier element 100 comprises a base portion 110; a top portion 120; a first side wall 130; and a second side wall 131, arranged opposite the first side wall; a first end wall 140 at a first end of the safety barrier element 100; and a second end wall 141, arranged opposite the first end wall 140, at a second end of the safety barrier element 100, all of which form a body of the safety barrier element 100. The base portion 110 is, in the exemplifying embodiment of Fig. 1, wider than the top portion 120. The base portion gradually widens downwards such that the base portion 110 forms a somewhat trapezoid cross-section. The exterior cross section of the top portion 120 is, on the other hand, generally rectangular. This outer shape of a safety barrier element body is known for being advantageous in terms of safety for possibly impacting vehicles. However, other shapes of the cross-section of the base and top portions, such as rectangular or triangular, are also applicable within the inventive concept.

[0030] The first and second side walls 130 and 131, as well as the first and second end walls 140 and 141 are, in the exemplifying embodiment, made out of metal, which is preferred because this material provides a resistant but also shock absorbing shell for the safety barrier element. It is, however, also possible to use other

materials for the wall elements 130, 131, 140, 141 of the safety barrier element 100, such as for example concrete or plastic.

[0031] In the exemplifying embodiment of Fig. 1, each side wall comprises a horizontal groove 30 which runs longitudinally of the entire safety barrier element 100 between the base and the top portions. The horizontal grooves 30 are arranged to provide a gripping portion for lifting cranes or hooks commonly used to manipulate safety barrier elements. The safety barrier element 100 is also provided with through holes 31 in the first and second side walls 130 and 131 at the center of the safety barrier element. The through holes are also arranged to enable lifting the safety barrier element by mechanical means, such as the fork of a fork lift.

[0032] The safety barrier element 100 further comprises a first anchoring member 150 and a second anchoring member 151. As exemplified in Fig. 1 by the cutaway views, both anchoring members 150, 151 extend laterally between the first and the second side walls 130, 131. The first anchoring member 150 is arranged at the first end of the barrier element 100. The second anchoring member 151 is arranged at the second end of the safety barrier element 100. In the exemplifying embodiment, the anchoring members 150, 151 are rods with a circular cross-section. Other shapes of the cross-section of the anchoring members 150, 151, such as for example square or rectangular, are however also applicable within the present inventive concept. Additional anchoring members may as well be present according to the present invention.

[0033] Furthermore, the safety barrier element 100 comprises a connector 160. The connector 160 is arranged to connect the safety barrier element 100 with an adjacent safety barrier element 100', as shown in Fig. 2c, by means of the anchoring members 151, 150' of the respective safety barrier elements 100, 100'. The connector 160 comprises a rear portion 161 and a front portion 162. In the exemplifying embodiment of Fig. 1, the rear portion 161 is arranged at the second anchoring member 151 of the safety barrier element 100. The front portion 162 is arranged to engage with the first anchoring member 150' of the adjacent safety barrier element 100' (see Fig. 2b), and to automatically enter a locked engagement with the first anchoring member 150'. The connector 160 can also be arranged having its rear portion 161 at the first anchoring member 150 of the safety barrier element 100, whereby the front portion 162 is arranged to engage with the second anchoring member 151' of the adjacent safety barrier element.

[0034] The connector 160 further comprises a release arm 164 which can be used to release the locked engagement with the anchoring member 150'. The connector 160 will be described in more detail in conjunction with Figs. 2-5.

[0035] Continuing now with reference to Fig. 1, the safety barrier element 100 further comprises a first protrusion, not visible in Fig. 1 but reference is made to the

corresponding first protrusion 170' of an adjacent safety barrier element 100' shown in Fig. 6a, and a third protrusion 70, both arranged at the first end wall 140, and a second protrusion 171 and a fourth protrusion 71 arranged at the second end wall 141. The first protrusion and the third protrusion 70 are spaced laterally of the safety barrier element 100, and so are the second and fourth protrusions 171, 71 as well. In the exemplifying embodiment of Fig. 1, the first and second protrusions 171 have a mainly rectangular shape seen from the side, and they are elongated in the vertical direction of the safety barrier element 100. Furthermore, from a side wall perspective of the safety barrier element 100, the first and second protrusions 171 have a width that is larger than their thickness. From an end wall perspective, the first and second protrusions have the shape of the cross-section of a truncated cone, where the top of the truncated cone faces the third and fourth protrusions 70, 71, respectively. From the end wall perspective, furthermore, according to the embodiment of Fig. 1, the first protrusion extends horizontally from the center of the end wall 140 towards the second side wall 131. The second protrusion 171 is reversely arranged, extending horizontally from the center of the second end wall 141 towards the first side wall 130. In this arrangement, the first protrusion of the safety barrier element 100 and the second protrusion of an adjacent safety barrier element 100' can overlap each other when the safety barrier elements are mounted together. Likewise, the second protrusion 171 of the safety barrier element 100 is arranged to overlap the first protrusion 170' of the adjacent safety barrier element 100', as illustrated in Fig 6b.

[0036] In a similar manner, the third and fourth protrusions 70, 71 are arranged at opposite ends of the respective safety barrier element end walls 140, 141. The third and fourth protrusions 70, 71 are thus arranged such that the first and third protrusions 70 of the safety barrier element 100 overlap the second and fourth protrusion 171', 71' of the adjacent safety barrier element 100'. Likewise, the second and fourth protrusions 171, 71 of the safety barrier element 100 are arranged to overlap the first and third protrusions 170', 70' of an adjacent safety barrier element 100', as illustrated in Fig 6b

[0037] In the embodiment of Fig. 1, the third protrusion 70 consists of a protruding portion of the first side wall 130, which protrudes out from the safety barrier element in a longitudinal direction at the first end wall 140. In a similar manner, the fourth protrusion 71 consists of a protruding portion of the second side wall 131, which protrudes in a longitudinal direction at the second end wall 141. When two safety barrier elements 100, 100' are juxtaposed, i.e. placed end to end adjacent to each other, the first or second protrusion 171 and the protruding portion of the side wall 130 or 131 of the safety barrier element 100 can thus engage with the opposite protrusion 171' or 170' and protruding side wall 131' or 130' of the juxtaposed safety barrier element 100' to form an overlapping engagement, see Fig 6b. The engagement is

thereby stiffened such that it limits an angular movement between the juxtaposed safety barrier elements in the case of impact from a vehicle.

[0038] Referring now to the top portion 120 of the safety barrier element 100, which houses a channel 180 extending longitudinally along the entire safety barrier element 100. The channel 180 is arranged to house, at least partly, the connector 160 and the anchoring members 150, 151. It furthermore provides a supporting structure of the body of the safety barrier element 100 for the connector 160, on which the connector thus at least partly can rest.

[0039] Finally, still referring to Fig. 1, the safety barrier element 100 comprises downwardly extending members 190 at each end of the base portion 110, so arranged to provide feet on which the safety barrier element rests. Each downwardly extending member 190, from hereon also referred to as safety barrier foot, in the exemplifying embodiment comprises a rubber block 191 enclosed on two longitudinal sides by metal plates 192, see Fig. 8. However, other materials, especially those presenting a high friction coefficient against paved roads, are applicable to use for this purpose within the scope of the present inventive concept.

[0040] Figs. 2a and 2b show schematic perspective views of an embodiment of a safety barrier element connector 160 at two different positions. In Fig. 2a, the connector 160 is in an idle position. In this position, the connector 160 is retracted in the channel 180 and resting on the bottom thereof. The connector 160 does not protrude from the safety barrier element top portion 120, nor from the protruding side walls 130, 131 at the safety barrier end walls 140, 141. This is advantageous when transporting safety barrier elements seeing that the space required for storing thus can be reduced, and the connector 160 is protected from damages during transportation. In a second position, exemplified in Fig. 2b, the connector 160 is activated. In order to move the connector 160 from the idle position to the activated position, the connector 160 is pulled out from the body of the safety barrier element 100 using the release arm 164 of the connector 160, such that the connector 160 protrudes longitudinally of the safety barrier element 100 from the end wall 140, 141 thereof. From this position, the front portion 162 can engage with an anchoring member 150', 151' of an adjacent safety barrier element 100'.

[0041] Fig. 2b shows an embodiment of a safety barrier element 100 that is approaching an adjacent safety barrier element 100', the safety barrier element 100 having the connector 160 in an activated position while being lifted. As the safety barrier element 100 approaches the adjacent safety barrier element 100' it will reach a position in which the front portion 162 of the connector 160 enters in contact with a first anchoring member 150' of the adjacent safety barrier element 100'. In this position, as the safety barrier element is being lowered to the ground, the front portion 162 of the connector 160 is arranged to engage with the first anchoring member 150' of the ad-

5 adjacent safety barrier element 100' such that a locking engagement is activated. Once the engagement is established, the safety barrier element 100 that is being lifted can be set down completely. Due to the configuration of the second and fourth protrusions 171, 71 of the safety barrier element 100 and the first and third protrusions 170', 70' of the adjacent safety barrier element 100', the four protrusions 171, 71, 170', 70' overlap and contribute to providing a sound connection between the two safety barrier elements, such to withstand possible impacts from vehicles. The protrusions 171, 71, 170' and 10 70' furthermore provide guidance in the positioning of the safety barrier element 100 next to safety barrier element 100'. The safety barrier element 100 can be lifted in from the side, whereby it then enters in contact with the adjacent safety barrier element 100', either by the first protrusion at the first end wall 140 engaging with the second protrusion 171' of the second end wall 141' of the adjacent safety barrier element, or by the second protrusion 171 at the second end wall 141 engaging with the first protrusion 170' at the first end wall 140' of the adjacent safety barrier element 100'. Once an engagement of the corresponding protrusions of the safety barrier element 100 and the adjacent safety barrier element 100' has been achieved, the safety barrier element 100 is easily 25 steered into the position in which the connector 160 can engage with the first or the second anchoring member 150', 151' of the adjacent safety barrier element 100'.

[0042] Fig. 2c shows a cross-sectional side view of the connector 160 in a locked position, in which the connector 160 interconnects two adjacent safety barrier elements 100, 100' according to the present inventive concept. In this exemplifying embodiment of the safety barrier element 100, the rear portion 161 of the connector 160 is arranged at the second anchoring member 151 of the safety barrier element 100. The front portion 162 of the connector comprises a connecting hook 165 and a locking hook 163, by means of which the connector 160 provides a locking engagement with the first anchoring member 150' of the adjacent barrier element 100'. 30

[0043] Figs. 3a and 3b show cross-sectional views of an embodiment of the connector 160 in an open and a closed configuration, respectively. The connector 160 comprises a connecting part consisting of a bottom part 167 and a top part 168. The bottom and top parts 167, 168 are elongated, and are joined together by a welded pin 66 in a pivotal connection at the rear end of the connector 160. The rear portion 161 of the connector 160 comprises thus a rear portion of the connecting part, and thereby a rear portion of the bottom part 167 and a rear portion of the top part 168. Furthermore, the front portion 162 of the connector 160 comprises a front portion of the bottom and top parts 167, 168 of the connecting part. The connector 160 further comprises a locking part 169. 35 The locking part 169 is pivotally connected to the top part 168 at the front portion 162 of the connector 160, and arranged to provide the locked engagement in conjunction with the connecting part. More particularly, at the 40 45 50 55

front portion 162 of the connector, the top part 168 of the connecting part further comprises a connecting hook 165. The connecting hook 165 forms a recess 65, which is accessible from below, and which is arranged to receive and engage from above with the first anchoring member 150' or the second anchoring member 151' of an adjacent safety barrier element 100' when lowered down

[0044] More particularly, the top part 168 of the connector 160 comprises first and second opposite and parallel connector side walls 60, 61, see inter alia Fig. 2b, and the connecting hook 165 is constituted by connecting hook portions 64 at the front ends of the respective connector side walls 60, 61. Each connector side wall 60, 61 comprises a downwards facing arrow shaped protrusion 68, which is integral with the connecting hook portion 64 and positioned rear thereof. The arrow shaped protrusion 68 comprises a rod 69 which extends between the protrusions 68 of the connector side walls 60, 61 and interconnects them. The rod 69 is arranged to engage with grooves 19 in the bottom part 167 of the connector 160 when the connector 160 is in the closed configuration.

[0045] The locking part 169 is pivotally connected with the top part 168 at the lower point of the arrow shaped protrusion 68. More precisely, the locking part 169 is connected to the top part 168 by a pin 16, which extends between the lower points of the arrow shaped protrusions 68 of the connector side walls 60, 61. In the present embodiment, the locking part 169 has the shape of a bent arrow, comprising the pivotal connection to the arrow shaped protrusion 68 at one end, and the release arm 164 at the other end thereof. By means of the release arm 164, the connector 160 is manually operable between the open and the closed configuration. Correspondingly, the locking part 169 is moved between a released and a locked position when operating the release arm 164. The released position corresponds to the release arm 164 being lifted, as shown in Fig. 3a. As the release arm 164 is being lifted, the locking part 169 is rotated upwards and backwards, and the rotation is stopped by the rod 69 of the arrow shaped protrusion 68 of the connector 160. The locked position corresponds to the release arm 164 extending in the longitudinal direction of the safety barrier element 100 and resting on a pin 62 extending between the connector side walls 60, 61 of the connecting hook portions 64, as shown in Fig. 3b.

[0046] At the point of connection with the arrow shaped protrusion 68, the locking part 169 comprises a locking hook 163. The locking hook 163 is arranged to cooperate with the connecting hook 165 to lock the engagement with an anchoring member 150', 151' of an adjacent safety barrier element 100'. More precisely, the locking hook 163 is arranged to close the recess 65 of the connecting hook 165, thereby enclosing the anchoring member 150' or 151' when the locking part 169 is in the locked position, that is when the release arm 164 is resting in the longitudinal direction of the safety barrier element 100. The

locking part 169 is arranged such that it is pushed into the open position as the bottom surface 63 of the locking hook 163 slides upon an anchoring member, such as a rod or the like, of an adjacent safety barrier element. As the locking hook 163 slides upon, for example, the second anchoring member 151' of an adjacent safety barrier element 100', the release arm 164 is lifted. This can occur when the connector 160 is lowered over the same anchoring member 151'. Once the second anchoring member 151' reaches the front end of a bottom surface 63 of the locking hook 163, the locking hook 163 is arranged to pivot downwards under the weight of the release arm and lock the engagement with the second anchoring member 151' of the adjacent barrier element 100' from below, by closing the recess 65 as described above. Consequently, at the same time, the connecting hook 165 engages with the anchoring member 151' from above. Thus, the release arm 164 constitutes a counterweight in this stage, resulting in the locking hook 163 falling down as an effect of gravity whenever no lifting force is exerted on the locking hook 163 or on the release arm 164.

[0047] In the closed configuration, the connecting part comprises a longitudinally elongated cavity 67, which is formed between the top part 168 and the bottom part 167 of the connector 160. The height of the elongated cavity 67 is at least large enough to receive an anchoring member 150, 151 of the safety barrier element 100. Either of the first and the second anchoring members 150, 151 of the safety barrier element 100 can be enclosed within the elongated cavity 67. The elongated cavity 67 is arranged to allow the connector 160 to slide on either of the first and the second anchoring members 150, 151 of the safety barrier element 100 as the connector 160 is moved between the idle and the activated positions. In the idle position, the anchoring member 150 or 151 rests at a front end of the elongated cavity 67. In an activated position, the anchoring member 150 or 151 rests at the rear end of the cavity 67. The connector 160 is thus slidably movable between the idle position and the activated position. In the locked position of the connector 160, the anchoring member 150, 151 of the safety barrier element 100 remains at the rear end of the cavity 67.

[0048] The pivotal connection of the bottom part 167 and the top part 168 of the connector 160 allows for removing the connector from the safety barrier element 100. The pivotal connection also allows for arranging the connector 160 around either of the first anchoring member 150 and the second anchoring member 151 of the safety barrier element 100. In this manner, the connector 160 is releasably arrangeable at any one of the first and second anchoring members 150, 151 of the safety barrier element 100.

[0049] In the exemplifying embodiment of Fig. 3a-b, the bottom part 167 of the connector 160 further comprises a heel, i.e. a downwards protruding portion 166, which extends from the center towards the front end of the connector 160. In an activated position, the heel 166 is arranged to block the connector 160 from horizontally

sliding back into the channel 180 and to the idle position. Thereby, lifting the release arm 164 is necessary in order to move the connector 160 from the activated position to the idle position.

[0050] The connector 160 is, in the exemplifying embodiment, made out of metal. The weight of the material in the connector 160, as well as the pivotal connecting points of the connector parts, allows the connector 160 to stay in the closed configuration whenever no counterforce is placed upon the same.

[0051] Fig. 3c illustrates a side view of another embodiment of a connector 260 according to the present invention. In this embodiment, the connector 260 comprises a connecting part 267 and a locking part 269. The connecting part 267 is elongated and comprises a rear portion and an opposite front portion which comprises a connecting hook 265. Thus, a rear portion 261 of the connector 260 comprises the rear portion of the connecting part 267, and a front portion 262 of the connector 260 comprises the front portion of the connecting part 267 and the connecting hook 265. The connecting part 267 further comprises a longitudinally elongated cavity 27, and a slit 26 extending obliquely upwards and rearwards from the cavity 27 to the upper side of the connecting part 267. When the connector 260 is mounted, the cavity receives an anchoring member 150, 151 of the safety barrier element 100 via the slit 26. Consequently, when the connector 260 has been mounted, the anchoring member 150, 151 slides in the aperture 27 when the connector 260 is moved between an idle position and an activated position, and vice versa. The locking part 269 is pivotally connected with the connecting part 267 at the bottom of the front portion 262 of the connector 260 with a bolt 16. The locking part 269 is further provided as described in the previous embodiment 160, comprising a locking hook 263 and a release arm 264. The slit 26 enables the connector 260 to be arranged at either the first anchoring member 150 or the second anchoring member 151 of the safety barrier element 100. The locking part 269 is thereby arranged to enter a locking engagement with either of the second anchoring member 151' and the first anchoring member 150' of an adjacent safety barrier element 100', in cooperation with the connecting hook 265 at the front portion 262 of the connector 260.

[0052] In the idle position, the anchoring member 150 or 151 of the safety barrier element 100 is arranged at the front end of the aperture 27, whereby the connector 260 does not protrude from the end walls 140, 141 or the side walls 130, 131 of the safety barrier element 100. When the safety barrier element is to be connected to an adjacent safety barrier element 100', the connector 260 is activated by moving the connector 260 by the release arm 264 towards the adjacent safety barrier element 100' such that the anchoring member 150 or 151 slides in the aperture 27 to reach the activated position. In the activated position, the anchoring member 150, 151 is thus arranged at the rear end of the aperture 27. From the activated position, the connector enters a locked position

as it enters in contact with the anchoring member 150' or 151' of the adjacent safety barrier element 100'. Upon contact between the connecting hook 265 of the connector 260 and the anchoring member 150' or 151', the latter slides on the bottom surface 63 of the locking hook 263. When the anchoring member 150' or 151' reaches the front end of the bottom surface 63, the locking hook 263 pivots downwards such that it closes the recess 65 under the connecting hook 265, whereby the anchoring member 150' or 151' is enclosed. To release the locked position of the connector 260, the release arm 264 is lifted such that the locking hook 263 pivots upwards and backwards, opening the recess 65 under the connecting hook 265. The connector is then further disengaged with the anchoring member 150' or 151' by lifting the release arm 264 such that the front portion 262 of the connector 260 is lifted and the connecting hook 265 disengages from the anchoring member 150' or 151'.

[0053] Referring now to Fig. 4, which shows perspective side and partly exploded views of another embodiment of a safety barrier element 400 and connector 460 according to the inventive concept. This embodiment of the safety barrier element 400 corresponds with the first described embodiment, except for the construction of the connector and recesses 432 provided at side surfaces of the channel 480. More particularly, the recesses 432 are provided opposite to each other at a predetermined distance from the second anchoring member 451. From an upper mouth each recess 432 extends obliquely downwards and towards the nearby end of the safety barrier element 400. The predetermined distances are governed by the connector 460 which comprises a connecting part 467 and a locking part 469. A rear portion 461 of the connector 460 comprises a rear portion of the connecting part 467, and a front portion 462 of the connector 460 comprises a front portion of the connecting part 467 and the locking part 469. The rear portion 461 further holds a fixing rod 468 in a direction perpendicular to the longitudinal direction of the safety barrier element 400. The fixing rod 468 protrudes from the connector side walls 60, 61 at both sides of the connector 460. The fixing rod 468 is arranged to engage in the recesses 432 of the side surfaces of the channel 480.

[0054] The connecting part 467 further comprises a vertically arranged groove 466 extending upwards from the bottom of the connector at a distance from the fixing rod 468 matching the predetermined distance between the lower ends of the recesses 432 and the second anchoring member 451 of the safety barrier element 400. In this manner, the vertically arranged groove 466 is arranged to engage in the second anchoring member 451 of the safety barrier element 400 when the connector 460 is lowered into the channel 480 while being engaged by means of the fixing rod 468 with the recesses 432. More particularly, when the connector 460 is being mounted it is slopingly held with its rear end being lower than its front end. First the fixing rod 468 is received in the recesses and then the front portion 462 is lowered and the anchor-

ing member 451 is received in the groove 466 of the connector 460.

[0055] Referring to the front portion 462 of the connector 460, it comprises a locking part 469 such as described in the previous embodiments of Fig. 3. The connector 460 is movable between an idle position and an activated position due to the fixing rod 468 which is pivotally engaged with the recesses 432. In the idle position, the connector 460 rests on a supporting structure of the body of the safety barrier element 400. In this embodiment, the supporting structure consists of the bottom of the channel 480. More precisely, the connector 460 is arranged in a longitudinal direction of the safety barrier element 400 within the channel 480, the front portion 462 being rotated towards the center of the safety barrier element 400. To activate the connector 460, it is rotated 180 degrees around the rear portion 461, such that the front portion 462 protrudes from the barrier element end wall 440, 441. The connector 460 is thereby pivotally movable between an idle and an activated position, and vice versa.

[0056] Since the recesses 432 extend obliquely downwards towards the nearest end of the safety barrier element 400, the connector 460 is prevented from being removed by a straight lift from the locked position or the activated position. Hence, in order to remove the connector 460 from the safety barrier element 400, it has to be unlocked by lifting the release arm 464. Subsequently, the connector 460 is pivotally lifted such that it disengages from the first anchoring member 450' of the adjacent barrier element and the second anchoring member 451' of the safety barrier element 400 to which the connector 460 is engaged by the rear portion 461. When disengaged from both anchoring members 450' and 451', the connector can be diagonally slid out of the recesses 432 and thereby released from the safety barrier element 400. It is to be understood that the same arrangement can be set at the first end wall 440 of the safety barrier element, such that the connector connects two adjacent safety elements by the first anchoring member 450 of the safety barrier element 400 and the second anchoring member 451' of the adjacent safety barrier element 400'.

[0057] Referring now to Fig. 5a - 5c, which show schematic perspective views of another embodiment of the safety barrier element 500 according to the present invention. In this embodiment, the connector 560 comprises a connecting part 567 and a locking part 569. The connecting part 567 is elongated and provides a rear portion and an opposite front portion which comprises a connecting hook 565. A rear portion 561 of the connector 560 comprises thus the rear portion of the connecting part 567, and a front portion 562 of the connector 560 comprises the front portion of the connecting part 567 and the connecting hook 565. The connecting hook 565 forms a recess 65, which is accessible from below, as described in previous embodiments. The rear portion of the connecting part 567 holds a fixing rod 568 by which it is pivotally connected with the first anchoring member

550 of the barrier element 500. In this exemplifying embodiment, the anchoring member 550 consists of recesses provided opposite each other at side surfaces of the channel 580. The anchoring member 550 extends obliquely, from an upper mouth, downwards and towards the first end wall 540 of the safety barrier element 500. The second anchoring member 551 consists of a rod or similar, which extends between the side surfaces of the channel 580, with its ends resting in recesses provided opposite each other at side surfaces of the channel, as described referring to the first anchoring member.

[0058] The locking part 569 is pivotally engaged with the connecting part 567 in a point below and to the rear of the connecting hook 565 at the front portion of the connector 500. It comprises a locking hook 563 and a release arm 564. The release arm 564 and the locking hook 563 are raised as the connector 560 is lowered over the second anchoring member 551' of an adjacent barrier element 500' due to the anchoring member sliding upon the bottom surface 63 of the locking hook 563. When the anchoring member 551' reaches the end of the bottom surface 63 of the locking hook 563, the locking hook 563 and the release arm 564 are pivoted downwards such to enter a locked position. When entering the locked position, the connecting hook 565 is arranged to engage with the second anchoring member 551' from above. Furthermore, the locking hook 563 provides a locking engagement with the second anchoring member 551' from below. To release the locking engagement with the anchoring member 551', the release arm 564 is lifted. Lifting the release arm 564 results in raising the locking hook 563, unsealing the recess 65 of the connecting hook 565, whereby the connecting hook 565 can be disengaged from the second anchoring member 551' of an adjacent safety barrier element 500'. It should be understood that the first and second anchoring members 550, 551, as described in this embodiment, could be reversed such that the first anchoring member 550 consists of a rod or the like, and the second anchoring 551 member consists of the recesses as described above. In an embodiment of the invention, the rod of the second anchoring member 551 is releasably arranged in the recesses at side surfaces of the channel 580 such that it can be slid out of the recesses and, subsequently inserted in the recesses of the first anchoring member 550. The connector 560 can thereby be connected at either end of the safety barrier element 500.

[0059] Fig. 5b and 5c show the connector 560 in two alternative idle positions. In Fig. 5b, the connector 560 is in a vertical position, engaged with the safety barrier element 500 by the fixing rod 568 at the first anchoring member 550 of the safety barrier element 500. In Fig. 5c, the connector 560 is in a different idle position. Here, the connector 560 has been folded back into the channel 580 between the two side walls 530, 531 of the safety barrier element 500 and rests in a longitudinal direction of the same, supported by the bottom of the channel 580.

[0060] In the exemplifying embodiments of Fig. 5a-c,

the connector can thus be pivotally moved between the idle and the locked position. To connect two adjacent safety barrier elements by means of the connector 560, the latter is manually moved from the idle position to the locked position by lifting the release arm 564.

[0061] Referring to Figs. 6a and 6b, which are top views of end portions of two adjacent safety barrier elements 100, 100' according to an embodiment of the safety barrier element 100, 100', and Fig 6c, which is a top view of the same adjacent safety barrier element end portions with a connector 160 that connects the two safety barrier elements according to the present inventive concept. Thus, Fig. 6a shows how the second and fourth protrusions 171, 71 of the safety barrier element 100, and the first and third protrusions 170', 70' of the adjacent safety barrier element 100' engage in an overlapping manner. The first protrusion 170' of the adjacent safety barrier element 100' has been received in the space between the second protrusion 171 and the fourth protrusion 71 of the safety barrier element 100, and the second protrusion 171 of the safety barrier element 100 has been received in the space between the first and third protrusions 170', 70' of the adjacent barrier element 100'. Thus, seen from one of the sides to the other across the middle of the interconnection, from top to bottom of Fig. 6b, the following portions are passed; the fourth protrusion 71 of the safety barrier element 100, the first protrusion 170' of the adjacent safety barrier element 100', the second protrusion 171 of the safety barrier element 100, and the third protrusion 70' of the adjacent safety barrier element 100'. It should be understood that, at the other end of the safety barrier element 100, the first and third protrusions 170, 70 of the safety barrier element 100, and the second and fourth protrusions 171', 71' of an adjacent safety barrier element 100' also are engageable in an overlapping manner.

[0062] The second anchoring member 151 of the safety barrier element 100 and the first anchoring member 150' of the adjacent safety barrier element 100' are also illustrated in Figs. 6a and 6b. The anchoring members 150', 151 are engaged, in Fig. 6c, with the connector 160 such that the two safety barrier element end portions are in a locked engagement. Here, the first anchoring member 150 of the safety barrier element 100 and the second anchoring member 151' of the adjacent safety barrier element 100' are engaged with the connector 160. The connector 160 is engaged with the anchoring members 150', 151 as described in any of the aforementioned embodiments. In the embodiment of Fig. 6c, the connector 160 further comprises two circular or elliptical holes 17, which can be seen from above and are arranged on the top of the connecting part 168, 267, 467, 567 of the connector 160. The round holes 17 are arranged to receive posts of auxiliary equipment, such as lights or traffic signs or similar.

[0063] Referring now to Fig. 7a - 7b, which are cross-sectional perspective views of an embodiment of a safety barrier element. As mentioned above, the safety barrier

element 700 comprises a channel 780, which extends along the center of the entire safety barrier element 720 at the top portion thereof. The channel 780 comprises a bottom 80 as well as opposite channel side walls 82. In this embodiment, each channel side wall 82 is provided with a groove 85 extending longitudinally along the entire channel. The grooves 85 are arranged to receive and retain auxiliary equipment that can be fastened inside the channel and that extends beyond the safety barrier element top portion 720, such as light posts, traffic signs or similar. The auxiliary equipment can be inserted into the channel 780 of the safety barrier element 700 from above and rotated into the grooves 85 whereby it is retained. The bottom 80 of the channel 780 can furthermore comprise loop shaped fastening portions, not visible in Fig. 7, to provide lifting points to which mechanical lifting tools can be fastened for manipulating the safety barrier element 700.

[0064] The view of the channel 780 shown in Fig 7b, shows a canal 83 running down vertically to the base portion 710 from the bottom 80 of the channel 780. The canal 83 can be used to fill the base portion 710 with a ballast material, such as, but not limited to, concrete, sand, or water. The channel 780 is furthermore adapted to provide holes or hooks or other fastening elements that can be of use when lifting or in other ways manipulating the safety barrier element 700 with a crane or hook or similar.

[0065] Finally, referring to Fig. 8, which illustrates an end view of multiple safety barrier elements, according to an embodiment of the safety barrier element, stacked next to and on top of each other. The safety barrier element feet 190 are thinner than half the width of the longitudinally extending channel 180 of the top portion 120. The width of the base portion 110 of the safety barrier element is furthermore such that when a first and a second safety barrier element are juxtaposed with their longitudinal sides aligned, a third safety barrier element stacked on top of the juxtaposed safety barrier elements can have the feet 190 on one side of the third safety barrier element in the channel 180 of the first barrier element and its feet on the other side in the channel of the second safety barrier element. The thickness of the safety barrier element foot allows two feet to fit side by side in the channel 180 of one safety barrier element. Thereby, the safety barrier elements can be stacked in an overlapping manner, as illustrated in Fig. 8, without the use of any additional stacking material.

[0066] Multiple safety barrier elements connected in a row along an undefined distance forms a safety barrier system.

[0067] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments.

[0068] For instance, the safety barrier element can comprise a connector at each anchoring member of the

safety barrier element, both arranged to connect to adjacent safety barrier elements at their respective ends.

[0069] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A safety barrier element (100) comprising:

a base portion (110);
a top portion (120);
a first side wall (130);
a second side wall (131) being arranged opposite the first side wall;
a first end wall (140); and
a second end wall (141) being arranged opposite the first end wall,
wherein the top portion comprises a first anchoring member (150) and a second anchoring member (151), the first anchoring member being arranged at a first end of the safety barrier element and the second anchoring member being arranged at a second end of the safety barrier element,

the safety barrier element further comprising a connector (160) arranged to connect the safety barrier element with an adjacent safety barrier element (100') by means of anchoring members (150, 151, 150', 151') of the respective safety barrier elements, wherein said connector comprises a rear portion (161) and a front portion (162), the rear portion being arrangeable at any one of the first and second anchoring members of the safety barrier element and the front portion being arranged to engage with the nearest anchoring member of the adjacent safety barrier element,

wherein the front portion is arranged to automatically enter a locked engagement with the anchoring member of the adjacent safety barrier element.

2. The safety barrier element (100) according to claim 1, wherein the connector (260) comprises a connecting part (267), wherein the front portion (262) of the connector comprises a front portion of the connecting part, and the rear portion (261) of the connector comprises a rear portion of the connecting part, and

wherein the front portion of the connector further comprises a locking part (269), pivotally connected with the connecting part and arranged to provide the locked engagement in conjunction with the connecting part.

3. A safety barrier element (100) according to claim 2, wherein the front portion of the connecting part (267) comprises a connecting hook (265), and wherein the locking part (269) comprises a locking hook (263) arranged to cooperate with the connecting hook, wherein, when the rear portion (261) of the connector is arranged at the first anchoring member (150) of the safety barrier element, the connecting hook is arranged to engage with the second anchoring member (151') of the adjacent barrier element (100'); and the locking hook is arranged to lock the engagement.

4. A safety barrier element (100) according to claim 2, wherein the connecting part comprises a top part (168) and a bottom part (167) which are elongated and pivotally interconnected at a rear end of the connector.

5. A safety barrier element (100) according to claim 2, wherein the connecting part comprises a top part (168) and a bottom part (167) which are elongated and pivotally interconnected at a rear end of the connector, wherein the top part further comprises the connecting hook (165) at its front end, and wherein the locking hook (163) is in a pivotal connection with the top part, the pivotal connection being arranged rear of the connecting hook.

6. A safety barrier element (100) according to claim 1, wherein the connector (160) is arrangeable in an idle position, and at least one of an activated position and a locked position.

7. A safety barrier element (100) according to claim 6, wherein the connector (160) is slideably movable between the idle position and the activated position.

8. A safety barrier element (100) according to any one of the preceding claims, wherein the connector (160) is arranged in a longitudinal direction of the safety barrier element when in the idle position.

9. A safety barrier element (100) according to any one of the preceding claims, wherein the connector is releasably arrangeable at any one of the first and second anchoring members (150, 151).

10. A safety barrier element (100) according to any one of the preceding claims, wherein the connector (160) comprises a release arm (164) which is operable to release the locked engagement with the anchoring member (150', 151') of the adjacent safety barrier

element (100').

11. A safety barrier element (100) according to any one of the preceding claims, wherein the safety barrier element further comprises a first and a third protrusion (70) arranged at the first end wall (140), and a second and a fourth protrusion (171, 71) reversely arranged at the second end wall (141), whereby the first and the third protrusions are arranged to overlap with the second and fourth protrusions of an adjacent safety barrier element (100'). 5 10
12. A safety barrier element (100) according to claim 11, wherein the third protrusion (70) consists of a protruding portion of the first side wall (130) of the safety barrier element, and the fourth protrusion (71) consists of a protruding portion of the second side wall (131) of the safety barrier element. 15
13. A safety barrier element (100) according to any one of the preceding claims, wherein the top portion (120) of the safety barrier element comprises a channel (180) extending longitudinally along the entire safety barrier element, wherein the connector (160) is at least partly arranged in the channel. 20 25
14. A safety barrier element (700) according to claim 12, wherein the channel (780) comprises opposite channel side walls (82), wherein each channel side wall is provided with a groove (85) extending longitudinally along the entire channel. 30
15. A safety barrier element (100) according to any one of the preceding claims, further comprising downwardly extending members (190) at the base portion (11) so arranged to provide feet on which the safety barrier element rests. 35
16. A safety barrier element (100) according to claim 15, wherein the feet (190) of the base portion (110) are thinner than half the width of the longitudinally extending channel (180) of the top portion, such that the safety barrier element is stackable. 40
17. A safety barrier system comprising one or more safety barrier elements (100) according to any one of the preceding claims. 45

50

55

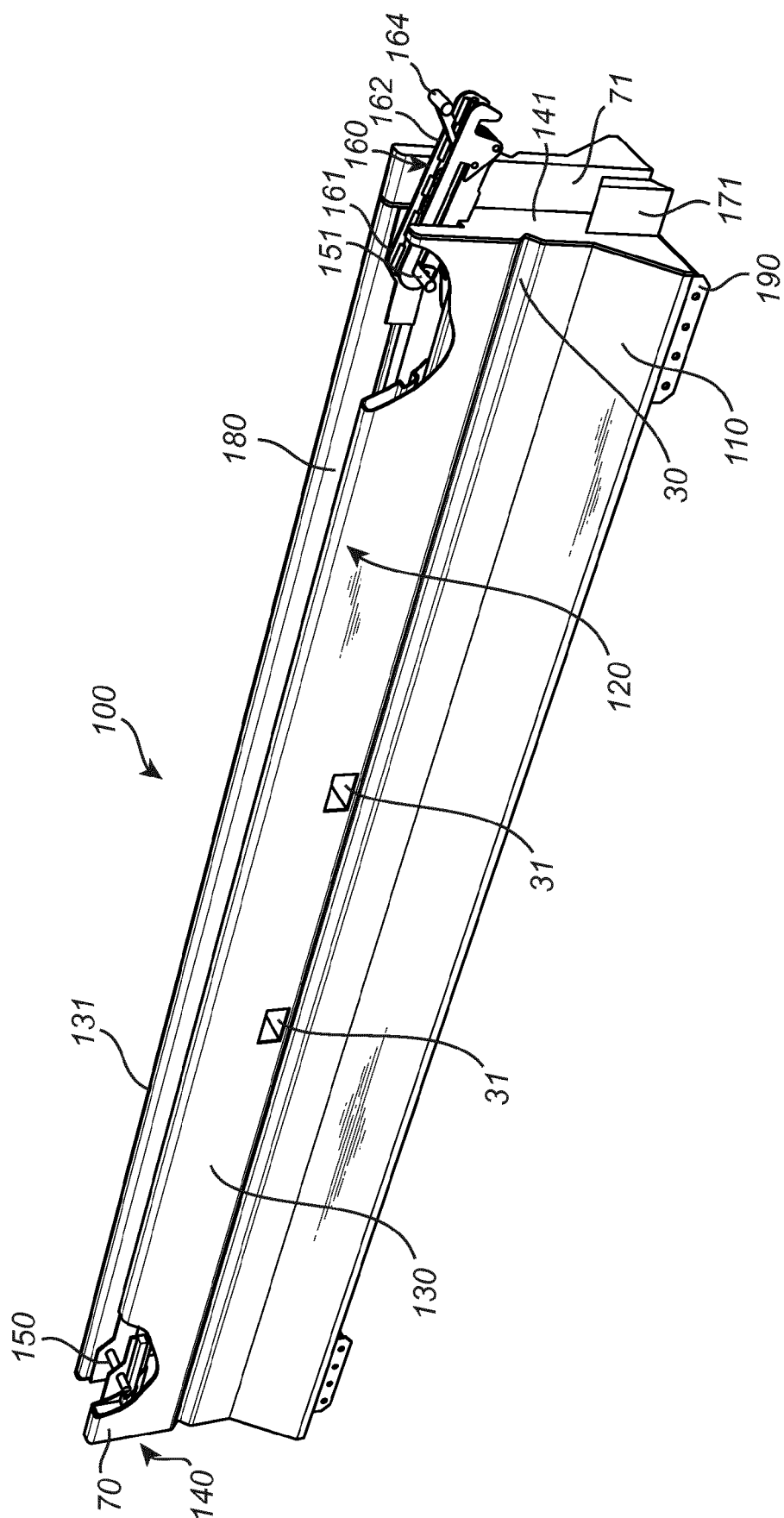


Fig. 1

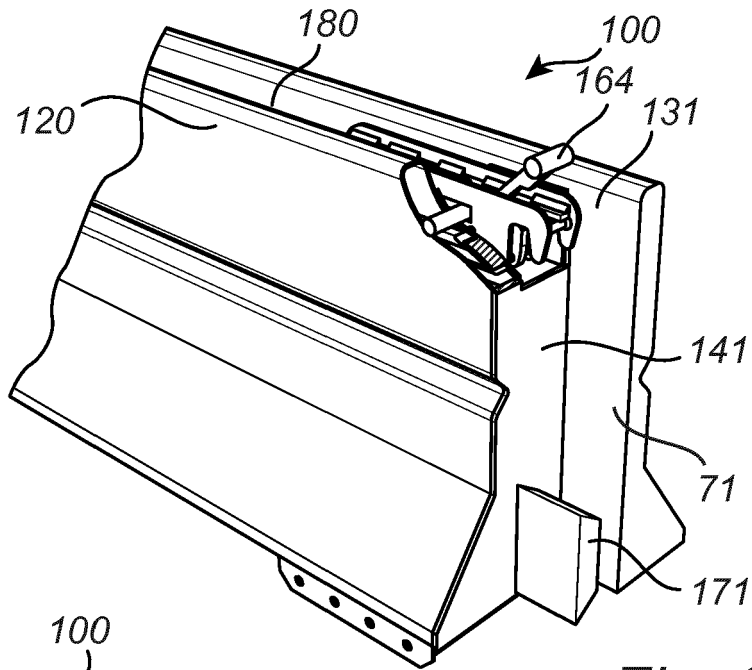


Fig. 2a

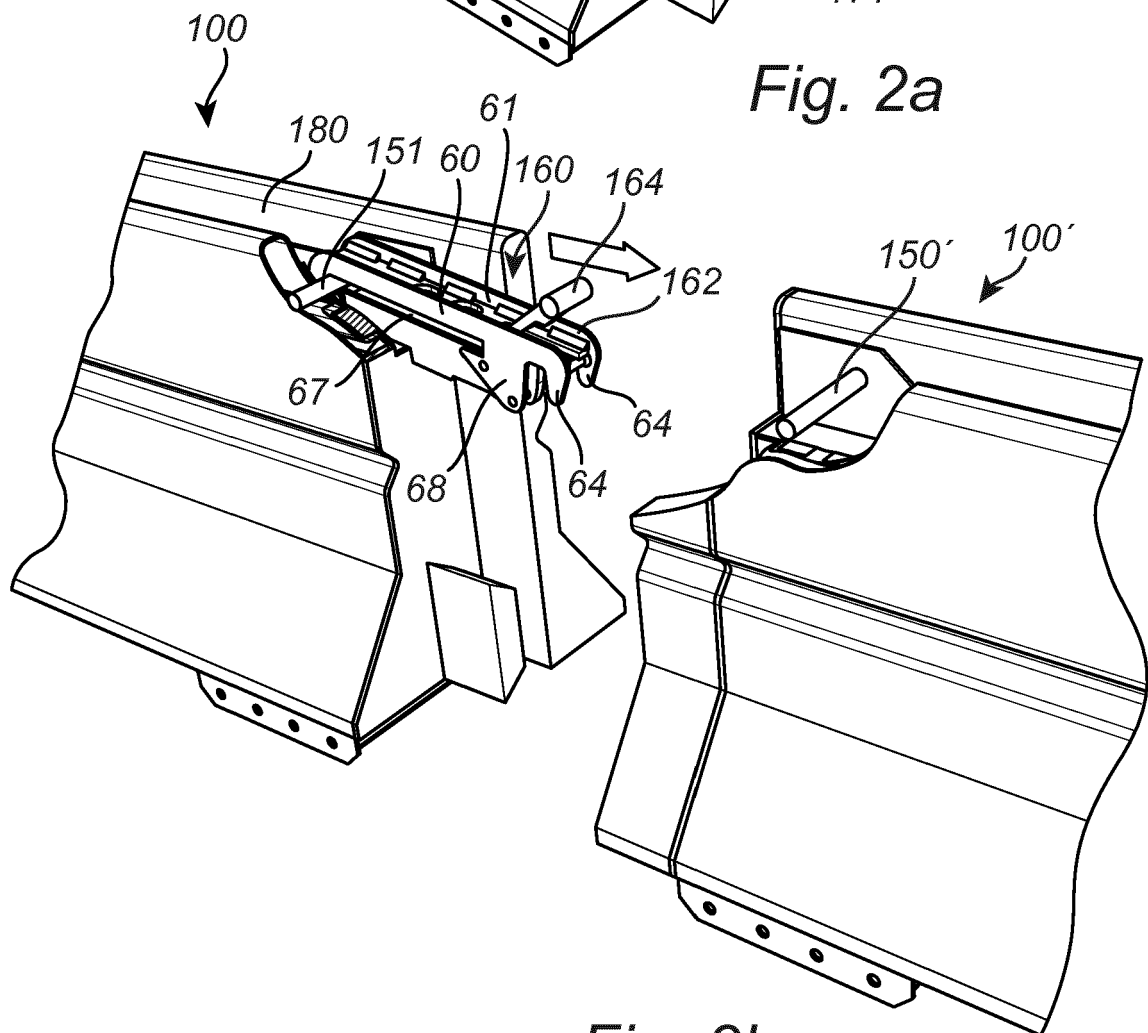


Fig. 2b

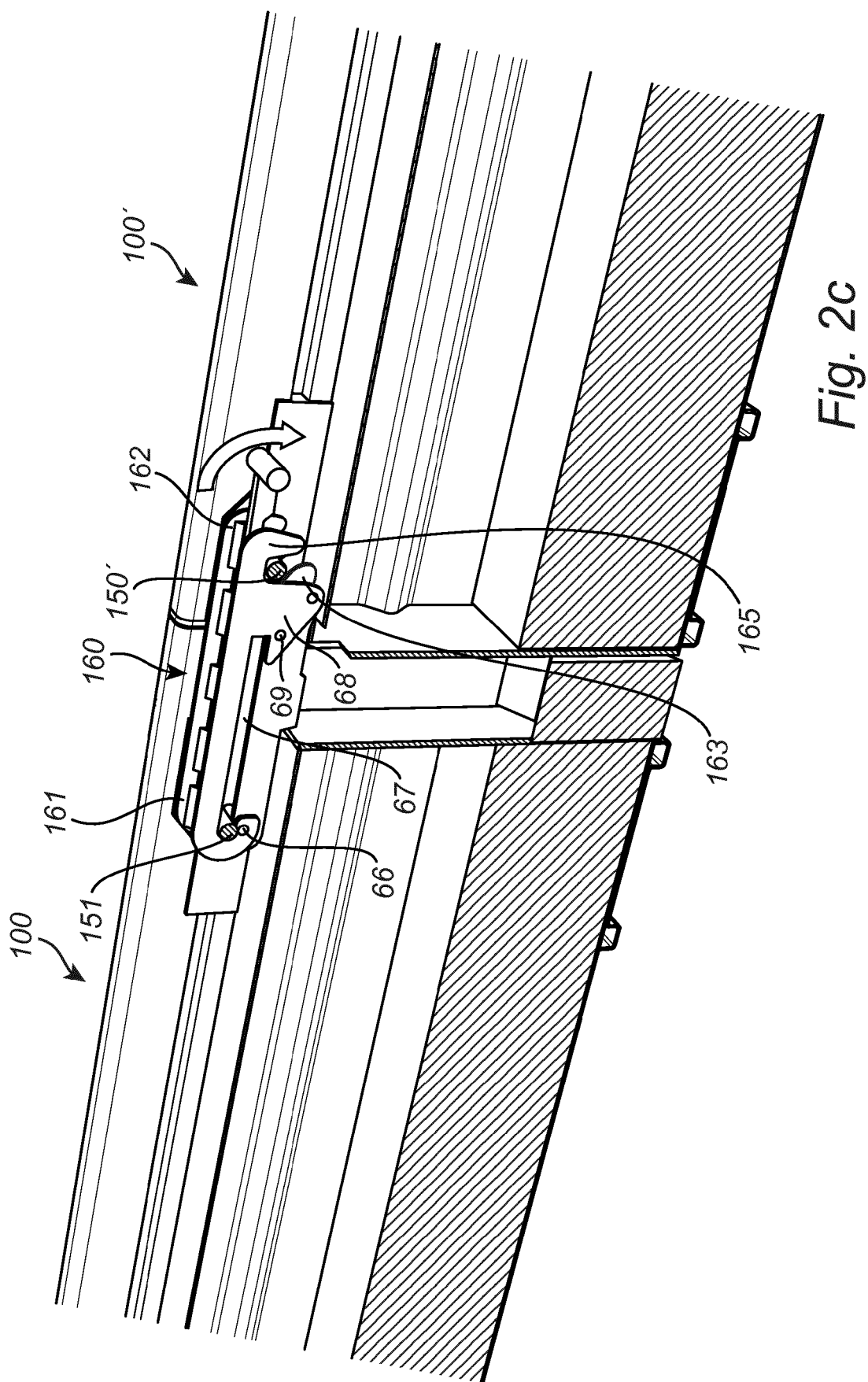


Fig. 2c

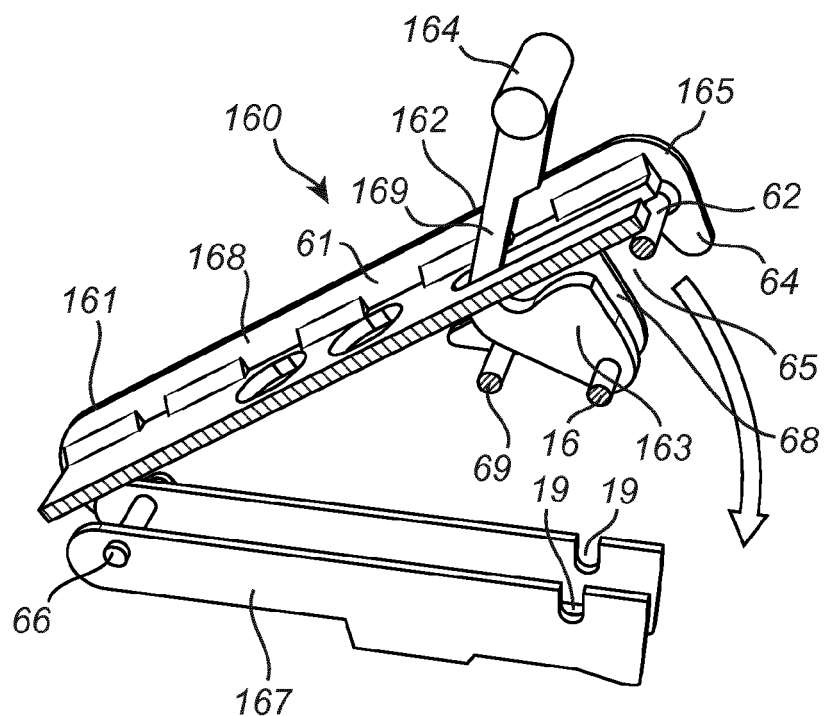


Fig. 3a

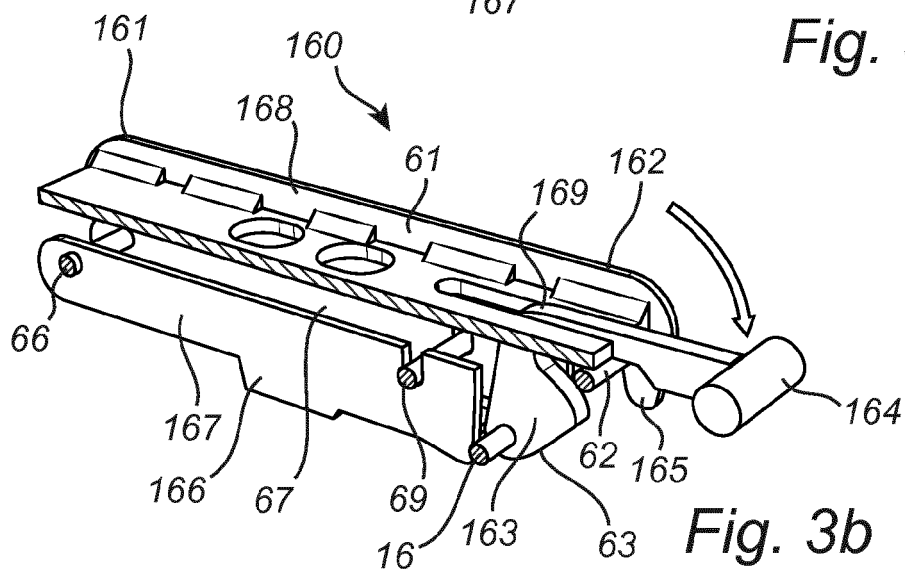


Fig. 3b

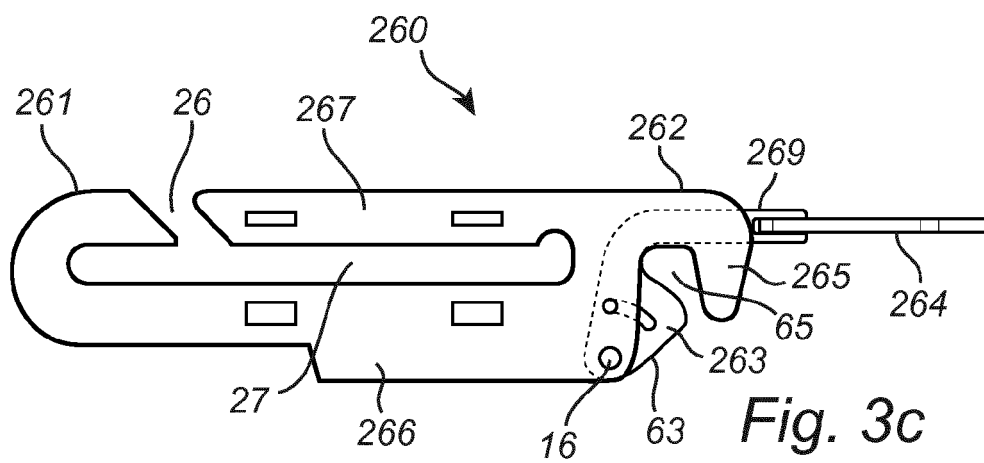


Fig. 3c

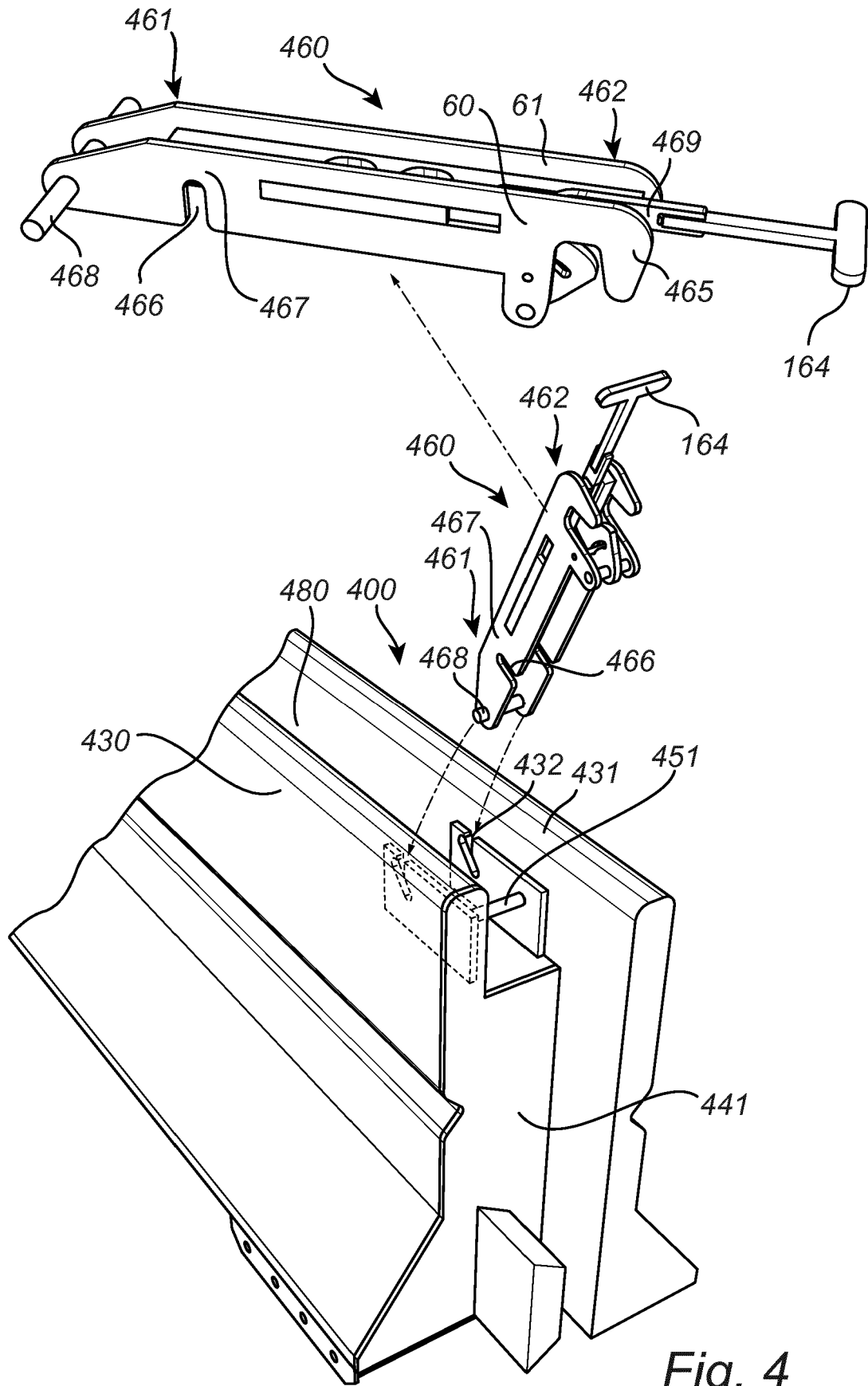


Fig. 4

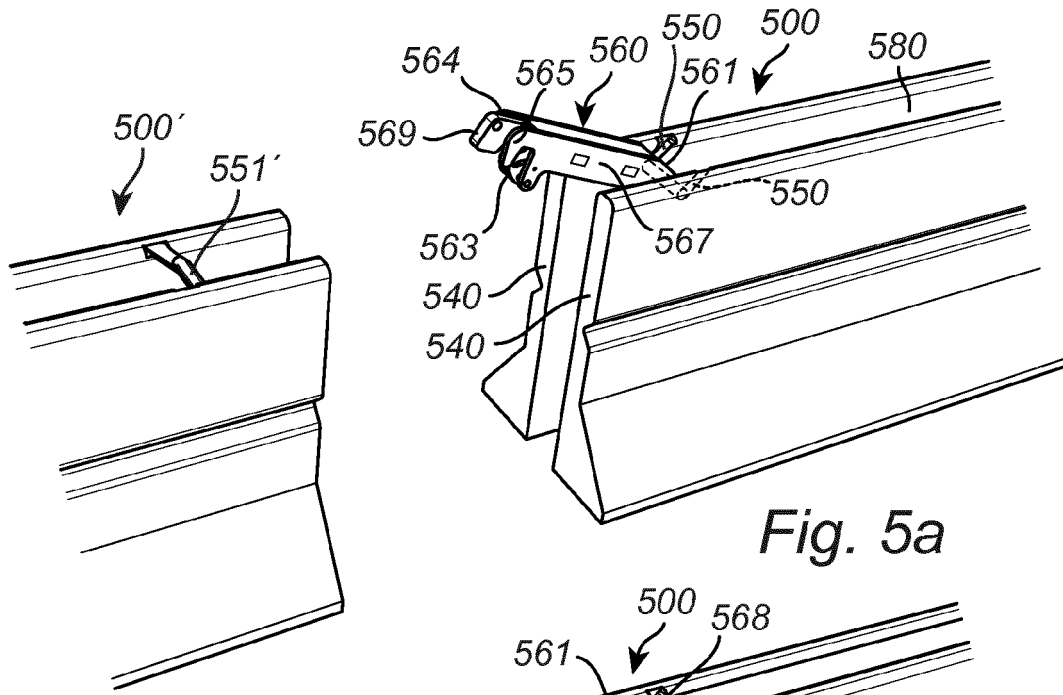


Fig. 5a

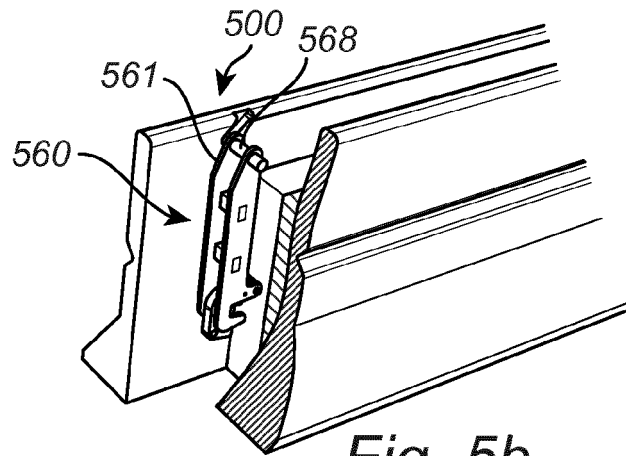
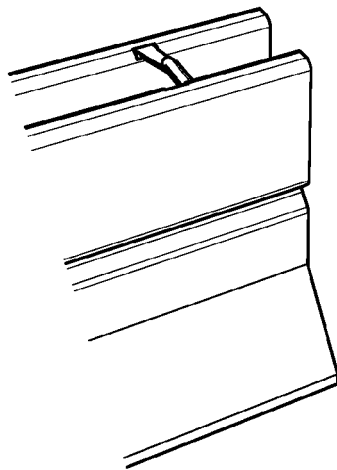


Fig. 5b

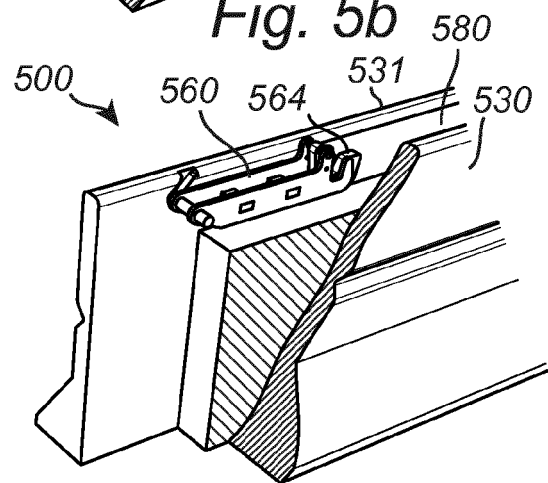
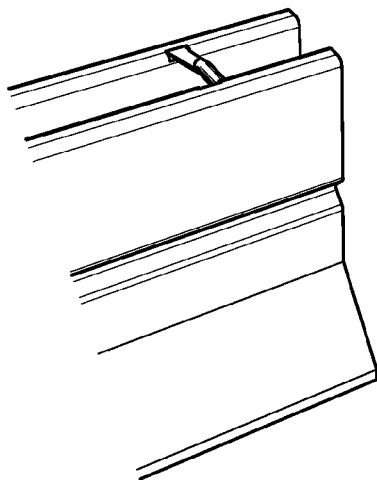


Fig. 5c

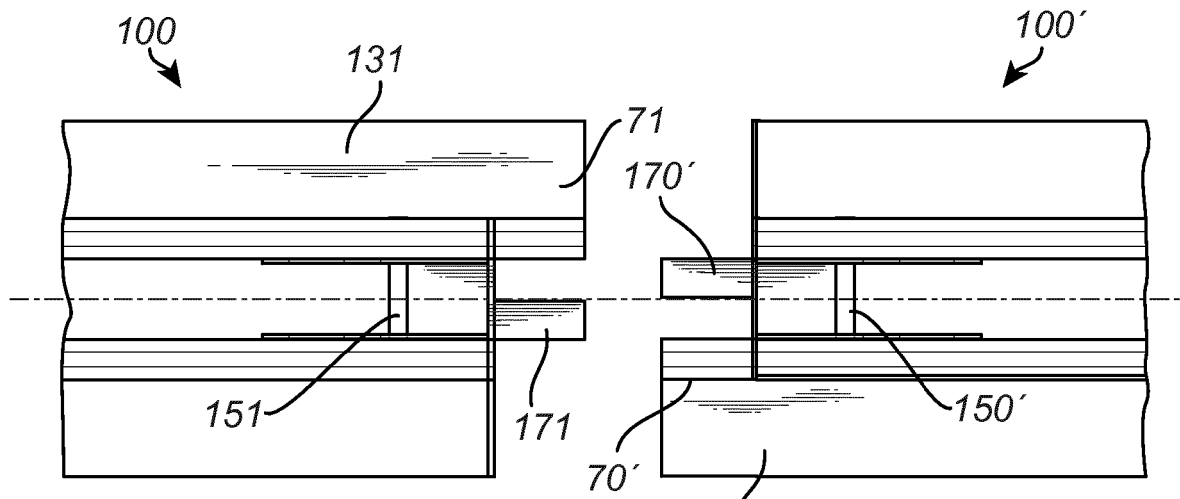


Fig. 6a

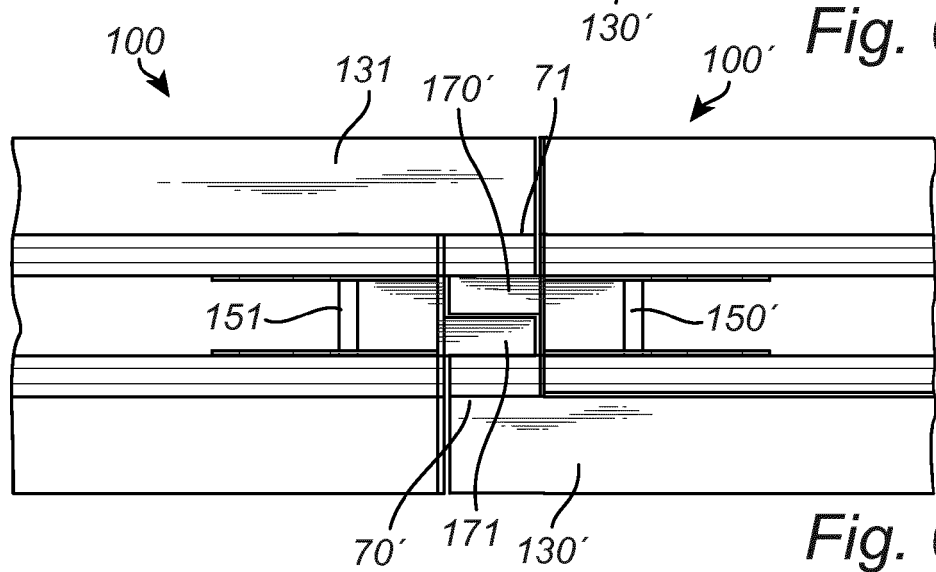


Fig. 6b

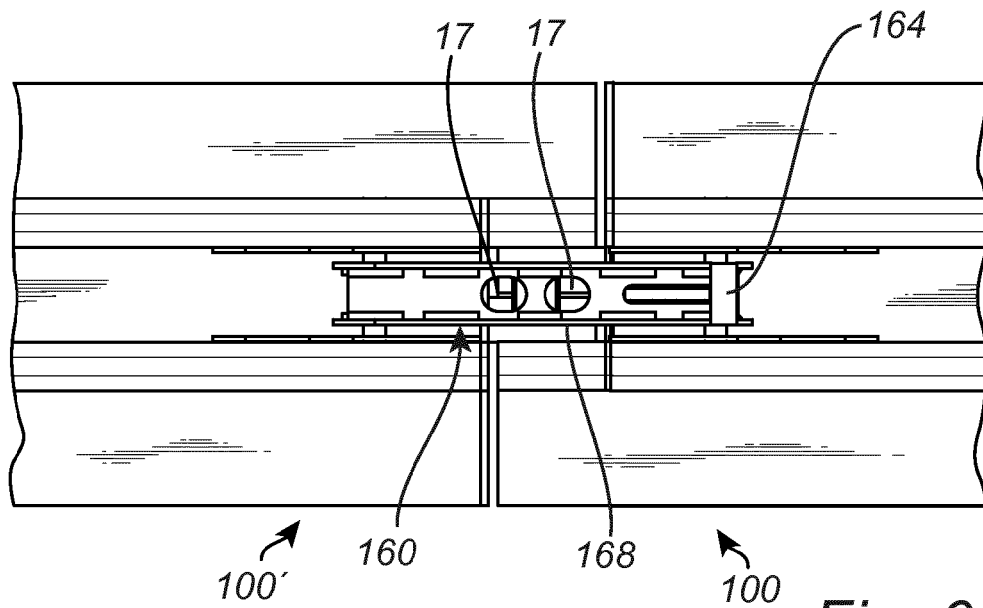


Fig. 6c

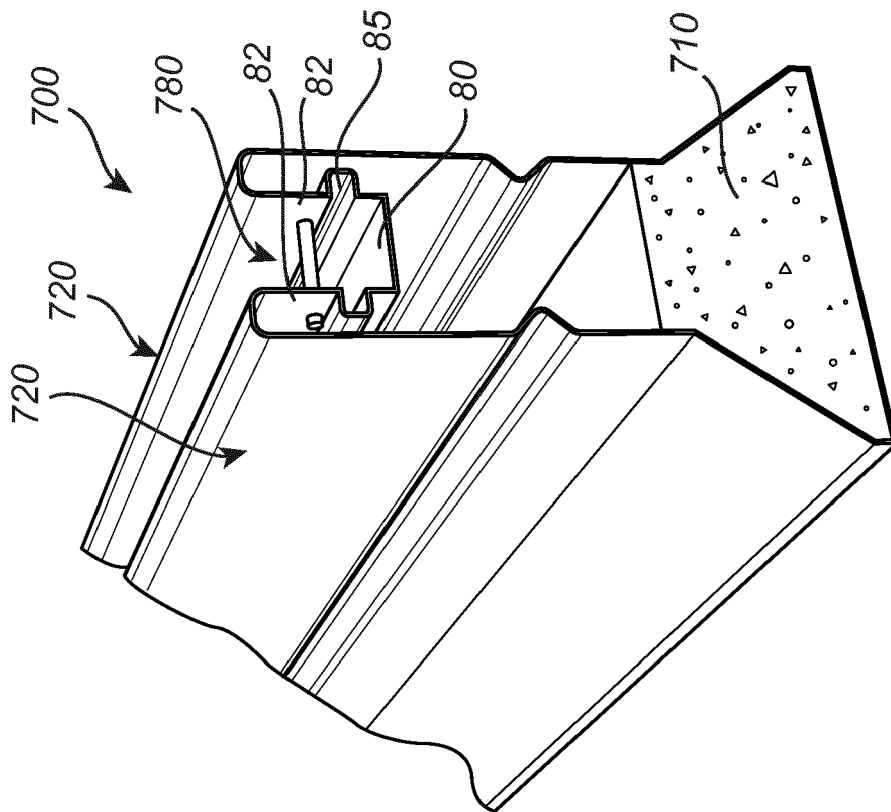


Fig. 7a

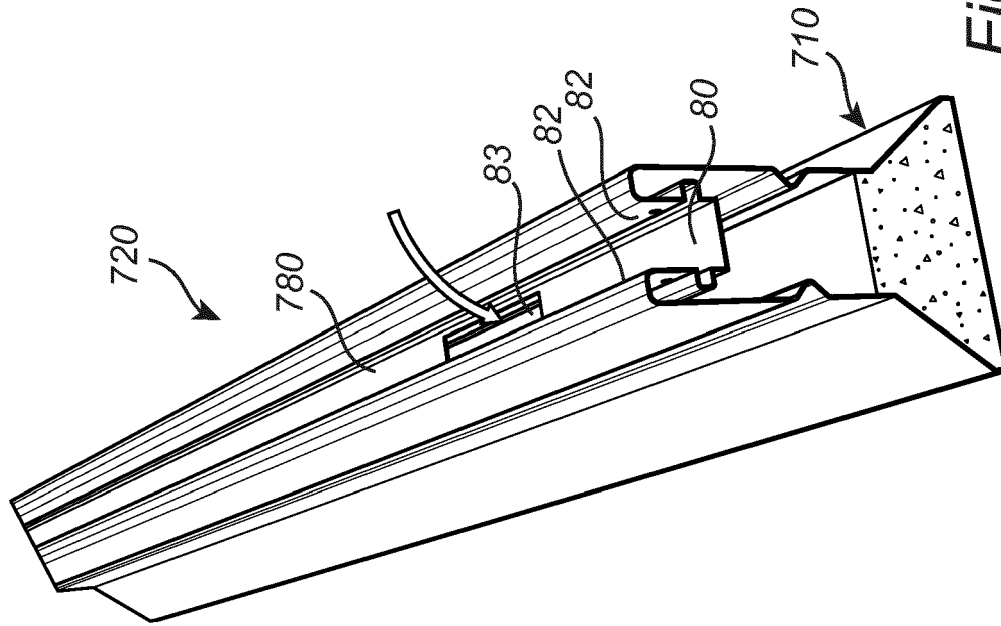


Fig. 7b

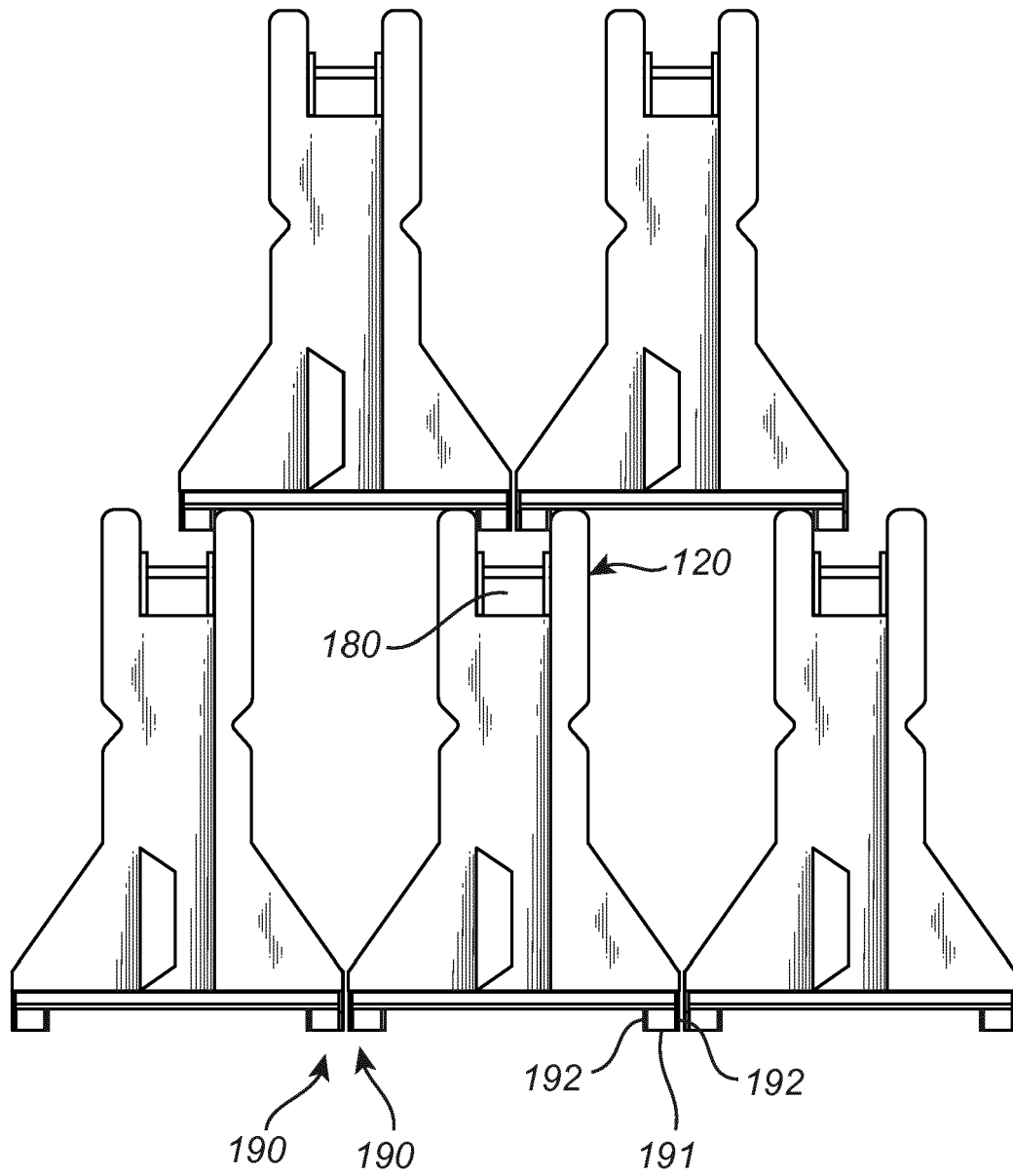


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 17 15 9196

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	EP 3 150 780 A1 (SAFETY SOLUTIONS JONSEREDS AB [SE]) 5 April 2017 (2017-04-05) * paragraphs [0001], [0004], [0019], [0020], [0026] * * figures 1,2,7 *	1,6,7,9	INV. E01F15/08
X	GB 2 524 833 A (SKARA CONCEPTS LTD [GB]) 7 October 2015 (2015-10-07) * page 1, paragraph 1 * * page 5, lines 10-14 * * page 6, lines 9-20 * * page 7, lines 8-29 * * figures 1,2,3,5,7,12,13 *	1,6-9, 15-17, 2-5, 10-14	
A	DE 298 17 764 U1 (LAURA METAAL EYGELSHOVEN BV [NL]) 24 December 1998 (1998-12-24) * page 1, paragraph 1 * * page 3, lines 13-30 * * page 7, line 19 - page 9, line 31 * * page 14, lines 20-22; figures 1-8 *	1-17	
A	DE 198 35 948 C1 (SPIG SCHUTZPLANKEN PROD GMBH [DE]) 28 October 1999 (1999-10-28) * the whole document *	1-17	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) E01F
Place of search Munich		Date of completion of the search 19 July 2017	Examiner Kremsler, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 15 9196

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-07-2017

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3150780	A1	05-04-2017	NONE
GB 2524833	A	07-10-2015	NONE
DE 29817764	U1	24-12-1998	NONE
DE 19835948	C1	28-10-1999	NONE

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1157167 A [0005]